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BRIDGING THE GAP: IMPROVING AEROMEDICAL EVACUATION BETWEEN MILITARY AND CIVIL AUTHORITIES DURING DISASTER RESPONSE

by

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Abstract

Hurricane Katrina and other recent natural disasters have highlighted the need for AE military assistance to state and national disaster response operations within CONUS. The purpose of this study is to evaluate the best method to employ an integrated AE patient movement and tracking system across all military, state and federal agencies for disaster response. The study answers this question: how can AE patient movement and tracking be improved between military and civil authorities in the event of a federal disaster?
This study uses the evaluation method to consider what steps should be taken to adopt a uniform aeromedical evacuation (AE) patient movement and tracking system for CONUS disaster response. The research provides a brief history of military AE, a case study of AE in Operation Iraqi Freedom and a case study of AE response in Hurricane Katrina. The research then examines the current state of AE in federal disaster response and evaluates concepts and systems that could be adopted for improved AE integration across multiple levels of state and federal government. Inputs from subject matter experts in patient movement and tracking are used in this evaluation process.

Finally, the research concludes by assessing the need for improved patient movement and tracking systems. The recommendations from this study include patient movement and patient tracking improvements. The primary recommendation from the study is to adopt JPATS as the universal patient tracking tool for all state and federal agencies in AE disaster response. The secondary recommendation is to adopt the Disaster Aeromedical Staging Facility (DASF) with Mobile Acute Care Strike Team (MAC-ST) concept as the AE staging standard for civil/military patient movement in federal disaster response operations.

INTRODUCTION

Overview of the Study

Aeromedical evacuation (AE) is an effective method of transporting sick or injured patients rapidly from basic medical treatment facilities to more advanced echelons of care. AE is primarily a U.S. military capability, although federal agencies within the Continental United States (CONUS) leverage military AE capabilities for federal disaster response. Since command structures and coordination are necessary for AE to function efficiently, it is important for civil and military authorities to have these systems and structures in place prior to a disaster event. Also, coordinated patient movement and tracking systems are likely to be ineffective if they are limited to only doctrine and theory. AE, like other military capabilities, must be exercised to maintain a high level of readiness for an actual event. Military AE components must integrate and train with their civilian counterparts to safely transport ill or injured civilians out of disaster zones and on to critical care treatment facilities.

The Nature of the Problem

Hurricane Katrina and other recent natural disasters have highlighted the need for AE military assistance to state and national disaster response operations within CONUS. Although disaster response is primarily a function of state and local Emergency Management Systems (EMS), state and local capabilities are rapidly overwhelmed during catastrophic events that injure and displace large numbers of people. When federal assistance is requested, the Federal Emergency Management Agency (FEMA) coordinates medical operations with the Department of Health and Human Services (HHS), the Department of Homeland Security (DHS) and other partnering agencies primarily through the National Disaster Medical System (NDMS). HHS is

the activating authority of the NDMS. The NDMS uses military AE to rapidly distribute the injured and severely ill patients to medical treatment centers across the country.

The Department of Health and Human Services (HHS), as the lead agency for patient movement, is charged with civilian patient tracking during disaster response from point of entry to destination medical treatment facility. However, the Department of Defense (DoD) has its own AE patient tracking system, which is known as the TRANSCOM Regulating and Command & Control Evacuation System (TRAC^{2}ES). Since TRAC^{2}ES is a military asset, HHS staff normally are not authorized to access TRAC^{2}ES and must use alternative tracking systems such as the Joint Patient Assessment and Tracking System (JPATS) instead. To complicate matters, some states have their own independent patient tracking systems and patient movement protocols, so there is no current national standard in place for patient movement or patient tracking in AE for Defense Support of Civil Authorities (DSCA) operations. The problem is that the lack of an integrated, efficient state and federal AE system could contribute to critical delays in treatment for civilians caught up in the next major federal disaster.

Purpose of the Study

The purpose of this study is to evaluate the best method to employ an integrated AE patient movement and tracking system across all military, state and federal agencies for disaster response. The current lack of a common national tracking system and differences in local protocols for patient movement create delays that may harm patients during domestic AE operations. For example, severely injured patients need to be routed to a level one trauma center quickly without exceeding that facility's capabilities to provide care. AE can relieve stress on hospitals in and near the disaster zone by rapidly moving patients to unaffected medical

treatment facilities across the country, but this requires efficient patient movement and tracking. Critics may argue that an integrated patient movement and tracking system is too expensive or complex to be practical, but numerous patient tracking and movement systems already in existence may be able to fill this compatibility gap. This study will explore gaps in AE doctrine between military and civil authorities and recommend changes to save lives and improve patient outcomes through rapid transport to comprehensive medical care.

The Research Question

Civilian agencies, such as the Federal Emergency Management Agency (FEMA), developed their own disaster response measures largely independent of the military, since civilian agencies have different roles and responsibilities than the DoD. When aeromedical evacuation of civilian casualties is needed, however, civilian agencies require assistance from the DoD. Therefore, the research question for this study is: how can AE patient movement and tracking be improved between military and civil authorities in the event of a Continental United States (CONUS) disaster?

Research Methodology

This research paper uses the evaluation method to consider what steps should be taken to adopt a uniform aeromedical evacuation (AE) patient movement and tracking system for CONUS disaster response. The research will begin with a brief background on the history of military AE and a discussion of how AE enables rapid transport of injured or ill patients to definitive medical care. The research will then lead into a discussion of the effectiveness of military AE through a case study of AE during Operation Iraqi Freedom (OIF). The research will then examine federal disaster response through a case study of Hurricane Katrina in 2005 and consider how proactive AE may have alleviated critical delays in medical care for the

civilian population.[1] Since Katrina had a huge impact on developing FEMA disaster response doctrine, the research will discuss the current AE doctrine for CONUS disaster response and examine potential gaps in that doctrine. With current doctrine and processes in mind, this research paper will develop criteria using existing literature and verify them with interviews of subject matter experts (SMEs) drawn from Air Mobility Command (AMC) and HHS regarding AE patient movement and tracking. These criteria will then be used to evaluate the viability of enhancements to both AE patient movement and tracking systems used in federal disaster response. This research will conclude by recommending adoption of an enhanced patient movement and tracking system or by suggesting an alternative solution and providing recommendations on how to implement such a solution.

LITERATURE REVIEW

Aeromedical Evacuation (AE) is a well-established system within the Department of Defense (DoD) for worldwide contingency operations, and the U.S. Air Force has produced a number of publications to codify AE doctrine. AFTTP 3-42.5, *Aeromedical Evacuation (AE) Tactical Doctrine,* is the most comprehensive Air Force publication on tactical AE doctrine and contingency operations across the range of military operations, including patient movement and tracking.[2] Additionally, AFI 11-2AE, *Aeromedical Evacuation (AE) Procedures,* is the standard Air Force instruction on AE flying operations and describes the roles and responsibilities of AE crew members.[3] These two publications form the foundation of AE doctrine and operations for the Air Force.

This research examined two case studies to compare AE in military operations against AE in civil/military operations. The first case study considered AE in Operation Iraqi Freedom and referenced research articles from LCDR Dale R. Harman and Eric Savitsky, MD, that were published in the journal *Military Medicine*. The next case study considered disaster response operations in Hurricane Katrina and referenced Dr. Joan Brunkard's mortality study, entitled "Hurricane Katrina Deaths, Louisiana, 2005." Dr. Daniel Haulman also provided key research statistics in his article, "The US Air Force Response to Hurricane Katrina."

The Air Force provides relatively little AE doctrinal guidance specific to Defense Support of Civil Authorities (DSCA) operations, however. Authoritative AE doctrine for DSCA is found in a patchwork of documentation from federal agencies such as the Federal Emergency Management Agency (FEMA), the National Disaster Medical System (NDMS) and the Department of Health and Human Services (HHS). Joint Publication 3-28, *Defense Support of Civil Authorities*, provides an excellent source of information on DSCA so the reader can

understand how AE fits in to the larger scope of operations. Col Lezama, MD, wrote an informative and more narrowly focused "Disaster Aeromedical Evacuation" article on how AE patient movement currently functions between the DoD and civil authorities, such as HHS, within the construct of the NDMS during federal civilian disaster response.[4]

Patient movement procedure and capability improvements were introduced in the wake of Hurricane Katrina, and those improvements considered the expansion of both military and civilian AE critical care capabilities. Critical Care Air Transport Teams (CCATT) capabilities are considered from sources such as AFTTP 3-42.5 and LtCol Theresa Brewer's article on CCATT for *Military Medicine*. Expansion of civil/military critical care capabilities are also discussed in the following Concept of Operations manual from the U.S. Transportation Command (USTRANSCOM): "Disaster Aeromedical Staging Facility (DASF) with Mobile Acute Care Strike Team (MAC-ST)."

USTRANSCOM exercises command and control over the DoD's patient movement process through the Global Patient Movement Requirements Center (GPMRC) and its network of regional Theater Patient Movement Requirements Centers (TPMRCs). GPMRC uses the TRANSCOM Regulating and Command and Control Evacuation System, also known as TRAC^{2}ES, for regulating and tracking patients during AE operations. TRAC^{2}ES is a sophisticated and secure patient tracking system utilized around the globe and across the armed services. Col Bloomquist is a recognized TRAC^{2}ES expert and he produced an informative, unclassified article in 1998 on the history of TRAC^{2}ES and an overview of its capabilities that is referred to in this research study.[5] A basic understanding of how TRAC^{2}ES works for tracking wounded military personnel is necessary to evaluate compatible and integrated systems for tracking civilian patients.

HHS is not under the command authority of the DoD and therefore HHS and other federal agency staff are not generally authorized to access TRAC^{2}ES. Since TRAC^{2}ES is the AE patient tracking system approved, managed and supported by USTRANSCOM, this creates a problem for civilian patient tracking during federal emergencies or disasters. One patient tracking system that might bridge this civilian/military gap is the Joint Patient Tracking and Assessment System (JPATS). Although JPATS is already in use by some state and federal agencies for disaster response, its use is not mandated across the state and federal disaster response system. Formal documentation on JPATS is not available from publishers in an unclassified source, but instead most documentation exists in the form of PowerPoint presentations to select groups of JPATS users. Joe Lamana is a JPATS Administrator and subject matter expert who was consulted for this research. Mr. Lamana provided a comprehensive patient movement presentation that describes joint civil/military patient movement in detail and discusses the specific capabilities of JPATS.[6]

BACKGROUND

Brief History of Aeromedical Evacuation

Aeromedical evacuation (AE) is an effective method of transporting sick or injured patients rapidly from basic medical treatment facilities to more advanced echelons of care. AE usually involves moving patients on fixed-wing aircraft accompanied by trained AE crewmembers, and AE missions typically range across distances of 300 miles or more.[7] Aeromedical Evacuation differs from casualty evacuation (CASEVAC) and medical evacuation (MEDEVAC) in both theory and practice. AE is performed after patients are already medically treated or "stabilized" for flight, whereas CASEVAC and MEDEVAC are designed to transport untreated or unstable patients from the incident site to a medical facility for treatment and stabilization of injuries.[8] Additionally, CASEVAC and MEDEVAC operations are typically accomplished with helicopters, or rotary-wing aircraft, due to their ability to land and take off in landing zones unsuitable for most airplanes.

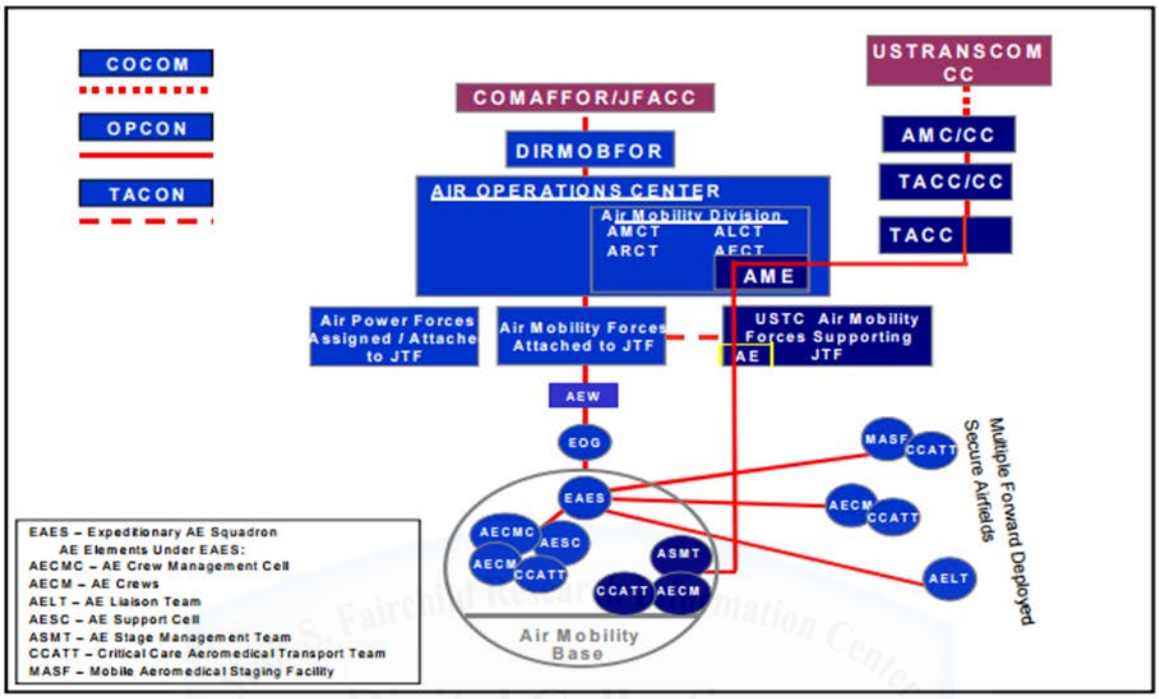
AE has its roots in military operations. The first actual aeromedical evacuation of patients by fixed-wing aircraft occurred in World War I. Although AE was extremely limited due to the capacity of early aircraft, the US Army "realized the need to transport the wounded by air" toward the war's end.[9] As aircraft improved over time, so did AE. Cargo planes were particularly well-suited for AE, since the absence of cargo meant more space within the fuselage of the aircraft for holding patients. Cargo planes enhanced the military's capabilities for long-range AE, and by 1942 more than 10,000 patients were moved by the C-47 airframe alone.[10]

Advancements in AE capabilities continued through World War II, the Korean War and the Vietnam conflict. As patient movement capabilities increased, so also did the need for patient tracking. By the advent of Persian Gulf War in 1991, each branch of the armed services

had developed their own casualty evacuation systems, including CASEVAC, MEDEVAC and AE. Whereas the systems were generally effective at moving patients from basic to more advanced levels of medical care, they were not well coordinated and integrated across the services. As one patient movement expert noted, "the medical regulating process and the casualty evacuation command and control system used were dichotomous, cumbersome, and required significant change."[11] In response to the AE part of the equation, the DoD developed TRAC^{2}ES. As mentioned earlier, USTRANSCOM is responsible for the oversight and implementation of TRAC^{2}ES. CASEVAC and MEDEVAC processes improved simultaneously with the implementation of TRAC^{2}ES, and military patient movement and tracking developed into a joint, cooperative system.

Current military AE structure and doctrine has remained relatively unchanged since the beginning of Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF), following the attack on the World Trade Center on September 11, 2001. Since AE is an extension of air operations, contingency AE units are organized under the operational control of the Director of Air Mobility Forces (DIRMOBFOR). Medical treatment facilities, by contrast, fall under control of the Surgeon General (SG). These chain of command distinctions are important to differentiate AE from clinical medical services. Since AE is tied to the transportation of patients, AE elements are typically collocated with other air operations assets. For example, the Aeromedical Evacuation Control Team (AECT) is often collocated with the Joint Air Operations Center (JAOC) in a deployed location. At a more tactical level of employment, AE staging facilities, such as the En-Route Patient Staging System (ERPSS), are usually located near an airfield to facilitate rapid loading of AE patients on to the aircraft.

Figure 1: Contingency AE Command Structure[12]



Case Study: Aeromedical Evacuation in Operation Iraqi Freedom

Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) stressed and refined the military's AE system. In contrast to the limited footprint of the Persian Gulf War, OIF employed hundreds of thousands of U.S. military personnel as "boots on the ground" among the host nation's citizenry, beginning with the initial invasion of Iraq in 2003. Iraq's military was quickly overpowered by the invading U.S. forces, but the initial victory did not result in immediate peace and stability within the country. Former Iraqi Army personnel and terrorist organizations such as Al-Qaeda in Iraq carried out a guerrilla war against U.S. occupation forces which resulted in a high number of AE casualties in the years following 2003.

Improvements in the patient movement and tracking systems implemented after the Persian Gulf War, such as the implementation of TRAC^{2}ES on a global scale through USTRANSCOM's Global Patient Movement Requirements Center (GPMRC), created a standardized patient regulating and movement system across the DoD. Wounded personnel were moved from incident site by MEDEVAC or CASEVAC to medical treatment facilities such as an Army Combat Support Hospital (CSH). If the patient needed to be moved out of theater for more intensive medical treatment, the CSH would generate a Patient Movement Request (PMR) in TRAC^{2}ES. GPMRC or the Theater Patient Movement Requirements Center (TPMRC) would forward the request to the validating flight surgeon on staff. The flight surgeon would review the patient's medical record in TRAC^{2}ES and find an open bed for that patient in an advanced treatment facility such as the Landstuhl Regional Medical Center in Germany. The patient would then be approved or "validated" for movement once he was assigned to a specific bed in Landstuhl. Non-validated patients were not to be moved by AE. This system minimized the time seriously ill or injured patients would spend in transit and minimized in-processing time once the patient reached his destination. Since TRAC^{2}ES was controlled by USTRANSCOM, AE patient movement was executed as a truly joint system across the armed services.

The number of military personnel moved via AE between 2003 and 2010 is staggering. During this time period, Air Mobility Command (AMC) reports that the AE system moved over 81,000 patients, including almost 14,000 soldiers with battle-related injuries.[13] Even with the threat posed by Improvised Explosive Devices (IEDs) and enemy combatants, it is interesting to note that the vast majority of patients moved via AE were not battle-related injuries. According to study published in *Military Medicine* from 2003 OIF data, "Disease/non-battle injuries were six times as common as battle injuries and 94% were classified as routine evacuees."[14]

Efficiencies of care in the military AE system had also drastically improved by the end of OIF. AMC reports that wounded military personnel "now have a 98 percent survival rate and are returned to the U.S. in three days or less."[15] By comparison, AMC also reports that "during Desert Storm, the survivability rate was 75 percent, and it took 10 days to move wounded patients to the U.S."[16] Improved airframes, AE patient movement procedures and tracking systems (such as TRAC^{2}ES) have translated into significant increases in the survivability of military casualties during modern contingency operations.

Case Study: Aeromedical Evacuation in Hurricane Katrina

When Hurricane Katrina struck the Gulf Coast in late August of 2005, the region was largely unprepared for the catastrophe that followed. New Orleans, the largest population center in the region, was hit particularly hard. FEMA, President Bush and the governor of Louisiana were heavily criticized in the media for slow and inadequate response to the crisis. U.S. military assistance was requested and received through FEMA and presidential order, but that assistance was significantly delayed by communication and legal jurisdiction issues between state agencies, federal agencies and the DoD. As Maj Ebbighausen aptly noted in his research on homeland defense operations, "History has shown that a major problem with disaster response is that unity of command becomes complicated when several government agencies respond to the same disaster without coordination."[17]

Aeromedical evacuation was effective in Hurricane Katrina, but the complications of legal jurisdiction and poor interagency communication mentioned above were detrimental to the initial implementation of AE. Some AE crews and AE Unit Type Codes (UTCs) were activated across the Air National Guard (ANG) and Air Force Reserve Command (AFRC) while the hurricane was yet underway. Unfortunately, these units were unable to assist with the

aeromedical evacuation of patients until the greater New Orleans area was declared a federal disaster area, two days after the hurricane had made landfall.[18] Most ANG units (located outside of the region) and AFRC units were prohibited to act until they could perform their duties under the auspices of U.S. Code Title 10, which refers to the federalized role of the armed forces within internal DSCA or homeland defense operations.[19] In contrast, Louisiana and Mississippi National Guard units were able to participate earlier in Hurricane Katrina's disaster response operations due to their Title 32 State Active Duty status.[20] As soon as the federal disaster zone was officially implemented, all available Air Force AE units went to work moving patients. Air Force AE units, including ANG, AFRC and Active Duty (AD) components, moved 2,602 patients from the Hurricane Katrina disaster area to medical treatment facilities across the United States.[21]

Despite the impressive numbers of patients moved via AE in Hurricane Katrina, the delays in the activation of federal disaster response took their toll on medically vulnerable populations. Dr. Brunkard's mortality study determined that 971 people died in Louisiana as a result of Hurricane Katrina.[22] Although a significant number of these patients died from drowning or immediate trauma related to the hurricane, it is noteworthy that over 300 of these patients presumably died from critical, but treatable illnesses. The population hardest hit in Katrina was the elderly population over age 75, and Brunkard's study concluded by suggesting that future disaster preparedness efforts must focus on evacuating and treating this "at risk" population.[23]

Command and control between the various disaster response agencies certainly contributed to delays in treatment, and other factors, such as the shortage of ambulances for ground transportation, also created delays for downstream AE. TRAC^{2}ES was not designed to

interface with civilian hospitals for regulating and tracking patients, so some of its advantages of coordinating patient movement between originating medical facilities to destination medical facilities were nullified in Hurricane Katrina. For example, USTRANSCOM was not able to identify all available beds in destination treatment facilities prior to regulating patients for flight, but achieving military standards for AE pre-flight validation would have introduced greater delays in patient movement. As described earlier, AE was able to effectively move thousands of patients through the system once initiated, but patient movement and tracking interfaces between federal disaster agencies were identified among the areas of improvement by Congressional review after Hurricane Katrina.[24] Despite the problems identified in the larger federal DSCA system, Hurricane Katrina demonstrated that early intervention of AE ultimately saves lives and improves patient outcomes.

ANALYSIS

Current State of Aeromedical Evacuation in Federal Disaster Response

Federal Agency Command Structure

Media figures and public officials severely criticized federal disaster response operations in the wake of Hurricane Katrina. Federal agencies did not always take a cooperative approach to solve problems and this created confusion around the roles and responsibilities of each participating entity. In the court of public opinion, FEMA received the lion's share of the blame for the "failures" of the federal government. In response to this criticism, FEMA and other federal agencies implemented significant changes to streamline the command structure for disaster response. FEMA falls under the organizational structure of the Department of Homeland Security (DHS) and is the lead coordinating agency for federal emergency response, so Congress recognized the need to elevate and simplify FEMA's reporting structure within DHS.[25] In 2008, DHS defined the FEMA administrator as principal advisor to the President of the United States (POTUS) and the Secretary of Homeland Security in accordance with the National Response Framework (NRF).[26] By restructuring the reporting chain of command, the FEMA administrator was given direct access to POTUS to improve response time during the next federal disaster.

FEMA is currently organized as lead coordinating agency over fifteen Emergency Support Functions (ESFs) established under the NRF for emergency response, ranging from Transportation (ESF #1) to External Affairs (ESF #15). This does not mean that FEMA is the primary agency for each of the ESFs, but FEMA plays a key role interacting with the public as the designated primary agency for Communications (ESF #2) and External Affairs (ESF #15). Although FEMA handles communications during federal disaster response, medical operations

fall under a different primary agency. AE is a subset of medical operations and belongs to ESF #8, Public Health and Medical Services. AE operations are directed through the DoD, but the primary agency for overall patient movement and tracking is HHS, under directive ESF #8 of the NRF.

Figure 2: Emergency Support Functions from the National Response Framework[27]

Emergency Support Function	ESF Coordinator (C) or Primary Agency (P)
ESF-1 Transportation	Department of Transportation (C/P)
ESF-2 Communications	DHS/National Communications System (C/P) DHS/FEMA (P)
ESF-3 Public Works and Engineering	Department of Defense/U.S. Army Corps of Engineers (C/P) DHS/FEMA (P)
ESF-4 Firefighting	Department of Agriculture/Forest Service (C/P)
ESF-5 Emergency Management	DHS/FEMA (C/P)
ESF-6 Mass Care, Emergency Assistance, Housing, and Human Services	DHS/FEMA (C/P)
ESF-7 Logistics Management and Resource Support	DHS/FEMA (C/P) General Services Administration (C/P)
ESF-8 Public Health and Medical Services	Department of Health and Human Services (C/P)
ESF-9 Search and Rescue	DHS/FEMA (C/P) Department of Defense/U.S. Air Force (P) DHS/U.S. Coast Guard (P) Department of Interior/National Park Service (P)
ESF-10 Oil and Hazardous Materials Response	Environmental Protection Agency (C/P) DHS/U.S. Coast Guard (P)
ESF-11 Agriculture and Natural Resources	Department of Agriculture (C/P) Department of Interior (P)
ESF-12 Energy	Department of Energy (C/P)
ESF-13 Public Safety and Security	Department of Justice (C/P)
ESF-14 Long-Term Community Recovery	DHS/FEMA (C/P) DHS (P) Department of Agriculture (P) Department of Housing and Urban Development (P) Small Business Administration (P)
ESF-15 External Affairs	DHS (C) DHS/FEMA (P)

Aeromedical Evacuation Command Structure

FEMA leads the overall federal disaster response effort, but HHS leads and coordinates medical response, including AE, through activation of the National Disaster Medical System (NDMS). HHS is the lead agency for ESF #8, but HHS is not able to implement the NDMS without the support of partnering agencies. The NDMS is facilitated through a partnership of DHS, the DoD, the Department of Veterans Affairs (VA), and HHS. The NDMS itself has three components: medical care, patient movement, and definitive care.[28]

Each of the partnering agencies within the NDMS has its own distinct role within the larger system. Through FEMA, DHS provides the NDMS with oversight to align its medical efforts with the larger strategic disaster response objectives. On an operational level, FEMA manages a national ambulance contract for the NDMS to provide short distance ground medical evacuation.[29] The DoD's role is central to the AE function of disaster response. As described earlier, the DoD's USTRANSCOM coordinates and regulates patient movement on all military aircraft. The role of the VA is to manage a network of Federal Coordinating Centers (FCCs) and contracted civilian hospitals in conjunction with the DoD. FCCs are located near major metropolitan areas to receive and distribute patients generated from a mass casualty event that could originate anywhere within CONUS.[30] HHS is the lead federal agency for the NDMS and is responsible for activating the NDMS when it is necessary. HHS also organizes Disaster Medical Assistance Teams (DMATs) of medical professionals to assist with patient movement and triage during a mass casualty event.[31] DMATs may be staffed by any contributing agency within the NDMS. As mentioned previously, HHS is additionally charged with overall civilian patient movement and tracking during disaster response operations.

Aeromedical Evacuation Patient Movement

It is important to grasp the basic organizational structure of the NRF to understand the more specific role of AE within federal disaster response. AE is only one piece of the disaster response puzzle, but it is an important one. Whereas much of the NDMS exists in a "dormant" state until activation, DoD AE maintains a relatively constant state of readiness. This is because the DoD is currently engaged in global military operations and requires the constant availability of AE support.

Civil disaster response operations are one of many DoD AE functions that span across a "spectrum of operations" that includes more than only wartime contingency operations.[32] Since basic operational concepts are relatively universal within military AE, however, there is little written into formal Air Force doctrine specific to DSCA operations. The other reason there is sparse documentation in Air Force doctrine regarding DSCA is because the DoD is not the lead agency for patient movement. HHS assumes this patient movement leadership role and the DoD assumes the role of a supporting agency.[33]

AE support for DSCA operations is typically requested through the NDMS once a mass casualty disaster is deemed imminent or has already occurred. AE may also be initiated before the disaster is declared a federal emergency if the local AE assets belong to that state's National Guard. AE could, in that situation, be requested under State Active Duty (SAD) status, otherwise known as Title 32. In most modern disaster scenarios that might require AE, however, the state's governor would be reluctant to stay in Title 32 status and quick to request federal assistance for additional funding and support. If POTUS designates a state as a federal disaster area, then AE support would operate under a federalized Title 10 status and could include both Active Duty and Air Reserve Component (ARC) forces. The Eighteenth Air Force (18 AF) takes

the lead on AE DSCA operations, although follow on AE is provided by ARC forces, which includes the Air National Guard and the Air Force Reserve. Roughly 90% of AE capabilities exist within the ARC, so reserve forces play a critical role in AE in both domestic and wartime contingency operations.[34]

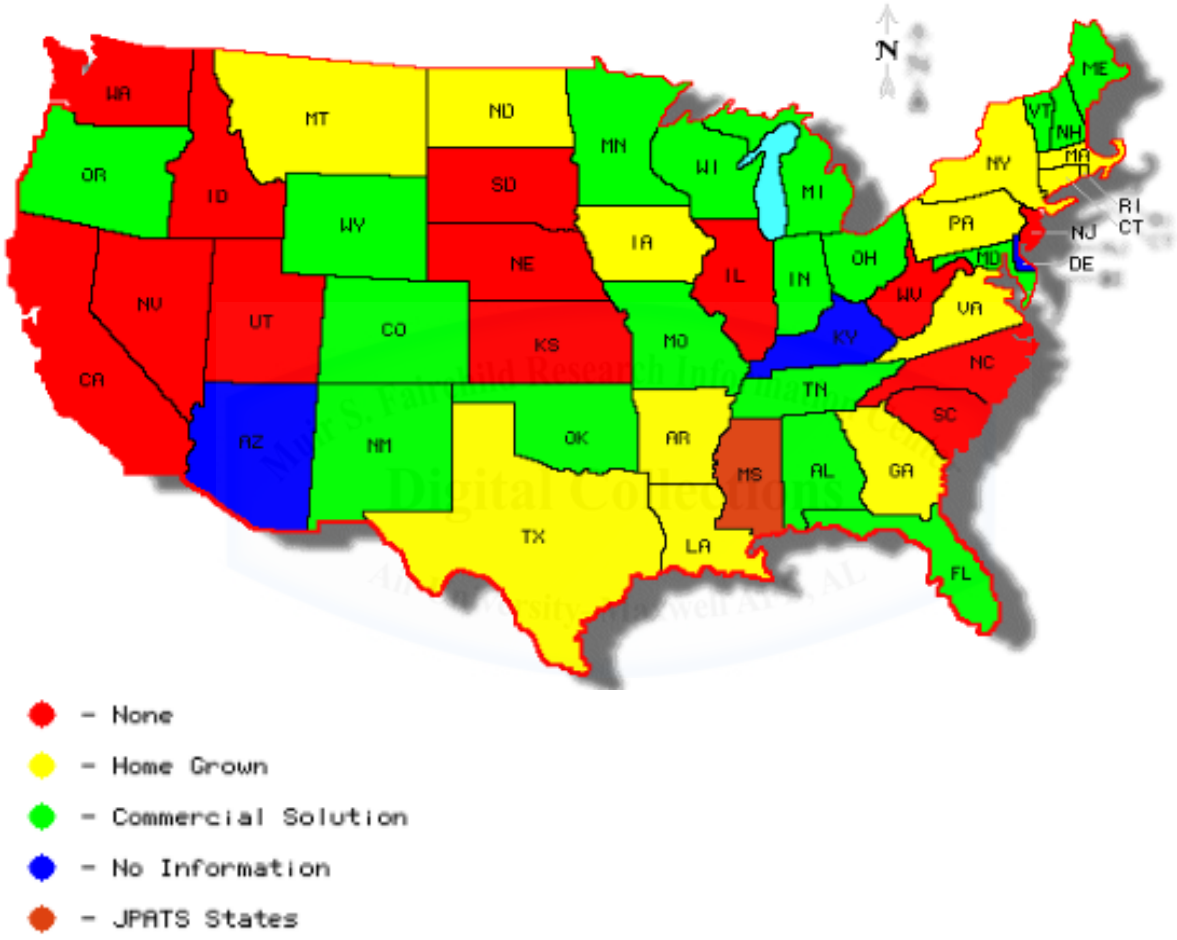
Aeromedical Evacuation Patient Tracking

In civil disaster response, the NDMS coordinates patient movement and tracking on military assets through the GPMRC or TPRMC, depending on the location of the originating airfield for AE operations. Prior to loading civilian patients on a military aircraft, TRAC^{2}ES is used to track AE patient movement from the Aerial Port of Embarkation (APOE) to the Aerial Port of Destination (APOD). As alluded to earlier in the study, TRAC^{2}ES is a battle-tested patient tracking and regulating system that works well within the confines of the DoD. TRAC^{2}ES is web-based, so it is accessible via the military Non-classified Internet Protocol (IP) Router Network, or NIPRNet. Unfortunately, TRAC^{2}ES is generally not available to non-DoD staff, so other tracking tools are required for civilian agency staff to have in-transit visibility of civilian patients.[35]

HHS staff use the Joint Patient Assessment and Tracking System (JPATS) for tracking civilian AE patients through the system. JPATS is another web-based application, but it can be accessed outside of military networks. JPATS can be populated with much of the same basic information that is available to the TRAC^{2}ES administrator, so JPATS can be somewhat "synched" with TRAC^{2}ES to provide a continuum of tracking from APOE to APOD. (Unlike TRAC2ES, JPATS does not contain medical record information on the patients, but it does contain the basic information needed to track patients during movement.) In a mass casualty scenario, it is recommended to set both TRAC^{2}ES and JPATS up in separate administrator teams

so that the tracking of patients can be tied together across the two platforms. Although JPATS is the standard HHS patient tracking tool, state and local government workers are not required to adopt JPATS as their standard. No single tracking tool is mandated for use by all state and federal government entities.

Figure 3: State Patient Tracking Capabilities[36]



In addition to JPATS and TRAC^{2}ES, however, some states have adopted their own "homegrown" patient tracking systems. Whereas some of these patient tracking systems may be robust and have good user interfaces, the apparent problem with customized applications is that they are generally not compatible with each other by design. Whereas this may not be an issue

for AE patient movement within a state, incompatible tracking systems become problematic once the patient is moved across state lines. In-transit visibility is lost without close coordination between state tracking teams. Patients may get "lost" in the system as they did during Hurricane Katrina in 2005.

Patient Movement Improvements

Critical Care Air Transport Teams

Critical Care Air Transport Teams (CCATT) provide advanced critical care capabilities to AE missions and have been a part of the U.S. Air Force AE system since 1996.[37] CCATTs were developed to augment AE crews, since seriously ill or injured patients require intensive medical resources and a standard AE crew consists of only two flight nurses and three medical technicians. AE crews had difficulty properly caring for critical care patients during small scale operations in Somalia and the Persian Gulf War, and these experiences shaped the development of the CCATT program.[38] CCATTs were used extensively in OIF and OEF, where increasingly sophisticated Improvised Explosive Devices (IEDs) were employed against U.S. ground troops. CCATTs also proved their value in recent domestic AE operations, such as Hurricanes Katrina and Ike, when CCATTs provided severely ill and compromised patients with intensive, in-flight medical services while being moved out of disaster zones and on to advanced medical treatment facilities in other regions of the country.

CCATTs are designed to address the needs of AE combat medicine. Combat trauma often involves gunshot wounds, burns or blast injuries, and patients suffering from these injuries often present with airway and circulatory injuries in one form or another. Based on these anticipated injury presentations, a standard CCATT is composed of one physician, one critical care nurse and one respiratory therapist. Each CCATT is equipped to treat three to five seriously

injured or ill patients in-flight from APOE to APOD. Additionally, these small, highly specialized patient care teams are trained to accompany their patients from the originating medical treatment facility all the way through the system to the destination medical treatment facility when necessary. By contrast, AE crews typically receive, onload and offload patients from back of the aircraft; patients are usually transferred from AE staging facilities directly to AE crews who are waiting on the airplane.

Evaluation: Expanding the Role of CCATTs in Federal Disaster Response

CCATTs are enablers of critical care AE, so can we expand their role in DSCA AE operations in addition to contingency operations? CCATTs are indeed valuable commodities, but they are a limited resource. CCATTs are composed of highly skilled medical staff who are difficult to recruit and retain in military service. Critical care nurses and physicians can earn lucrative salaries in private practice, so it is difficult to recruit these specialists to work in austere conditions on CCATTs. Additionally, the military's primary focus is on warfighting, and CCATTs are needed in the combat areas of responsibility (AORs). In the event of a federal disaster, it is possible that a majority of CCATTs stationed within CONUS may already be forward deployed in support of combat operations, which leaves a shortage of available CCATTs for domestic operations. Ken Hopper, HHS JPATS Administrator, explains the DoD's DSCA critical care capability shortage this way: "The first gap, in my opinion, is the number of assets applied to the situation….the DoD has a limited number of assets applied and that means a limited number of patients moved."[39]

DoD staffing for DSCA is driven primarily by wartime critical care tasking requirements, and the DoD patient population is significantly younger and "healthier" than the civilian population at large. According to Lisa DeDecker, Air Mobility Command (AMC) AE

consultant, when planning for critical care patient loads "the wartime planning factor for CCATT is ~8% (of the patient population, when averaging intra and intertheater requirements). DSCA planning factor (for critical care patients) is at least 30% (and) probably more like 40% (of the patient population)."[40] Simply put, DoD manning documents do not currently support a huge increase in defense budget spending for adding CCATTs that are not justified under wartime tasking requirements.

Disaster Aeromedical Staging Facility with Mobile Acute Care Strike Teams

In 2011, HHS and USTRANSCOM jointly developed a concept to improve AE patient staging and movement procedures between civilian and military entities during DSCA. They called this concept the Disaster Aeromedical Staging Facility (DASF) with Mobile Acute Care Strike Team (MAC-ST).[41] The DASF with MAC-ST concept was devised for increased critical care capabilities within DSCA AE operations. Based on historical data from hurricanes Katrina, Gustav and Ike, HHS estimated that a minimum of 20% of hurricane-related AE casualties would be critical care patients—and up to 10% of that population would additionally require some form of mechanical ventilation.[42] The 10-bed En-Route Patient Staging System (ERPSS-10) is a modular, flexible Air Force AE staging UTC designed primarily with wartime contingency operations in mind, but its basic unit structure consists of only 13 personnel. An ERPSS-10 must be quickly augmented to accommodate federal disaster response, and this is precisely why the larger scale DASF was implemented.

The DASF is a deployable Unit Type Code (UTC) that is designed for disaster response. The DASF is comprised of military personnel from a standard Air Force ERPSS-10 UTC that is bolstered by a Nursing Augmentation UTC. Whereas the basic ERPSS-10 personnel and equipment package is designed to treat and transport up to 40 patients in a 24-hour period, the

DASF is designed to treat and transport up to 140 patients in its first 24 hours of operation.[43] In addition to the patient care teams, the DASF also includes a Joint Patient Reporting Team (JPRT) to assist with patient accountability on the ground and a Joint Patient Movement Team (JPMT) to facilitate AE patient movement. The JPMT requires at least one TRAC^{2}ES expert for regulating and tracking AE patient movement from the DASF's APOE to the APOD. The DASF and JPMT are composed primarily of military personnel, but the JPRT is staffed by NDMS civilian agency representatives. The MAC-ST is staffed by HHS personnel who are trained in the CCATT concept of operations and function as a civilian counterpart to CCATT. MAC-STs do not accompany the patients onto military aircraft, as a CCATTs do, but in other ways they are very similar to CCATTs.[44]

Without DASF or ERPSS ground UTCs, DMATs are expected to stage patients for AE. DMATs are composed primarily of civil service agency personnel effective treatment of mass casualty patients, but DMATs are not well-equipped to stage patients for AE, since their focus is on triage and clinical care. DMAT personnel require training in AE patient movement to load patients onto aircraft. Additionally, an Air Force Aeromedical Evacuation Liaison Team (AELT) should be embedded with the DMAT to facilitate patient regulation and tracking. An AELT is composed of one flight nurse familiar with medical equipment approved for AE and one Medical Service Corps (MSC) officer who is trained in TRAC^{2}ES, the DoD patient regulating and tracking system. The AELT will support the DMAT's AE operations, although this setup is less than ideal for processing a large number of AE patients through the DMAT.

Evaluation: Adoption of DASF with MAC-ST for Federal Disaster Response

The DASF with MAC-ST concept was introduced as a way of enhancing the staging and movement functions of the ground medical teams during DSCA and to better prepare critical

care patients for the rigors of flight. The DASF is designed as a large scale, deployable unit specifically designed to support federal disaster response scenarios. MAC-STs are similarly designed to support the expected surge of critically ill or injured patients resulting from this same mass casualty event. Although the combined DASF with MAC-ST concept has been employed in a number of DSCA training exercises since its inception in 2011, it is interesting to note that it has not been employed in an actual federal disaster response incident as of the publication date of this study. Therefore, the effectiveness of the DASF with MAC-ST concept has not truly been tested. Exercises have yielded positive results, however, and it appears the DASF with MAC-ST does address a number of the shortcomings of command and control and efficiency of movement that were raised during the relatively recent hurricanes Katrina, Ike and Gustav.

DASFs add a significant capability to the preparation, staging and movement of AE patients from the ground through their organic patient care and movement teams. The MAC-ST adds critical care capabilities to the AE staging and movement effort much like a ground-based CCATT. MAC-STs are trained on in-flight equipment, for example, so they know which ventilators can accompany a patient onto an aircraft and which vents are not certified for flight. MAC-STs were developed as a force multiplier to Air Force Critical Care Air Transport Teams (CCATTs), since the MAC-ST could do the ground prep on critical care patients that usually required a CCATT. The DASF with MAC-ST concept also improves the communication gap between military units and civil authorities by embedding representatives from both groups in the same facility to process and move AE patients.

Patient Tracking Improvements

The TRANSCOM Command &Control Evacuation System

As mentioned earlier in the study, TRAC^{2}ES is the military's standard patient regulating and tracking system for AE. TRAC^{2}ES was developed in response to problems encountered moving and tracking military patients during the Persian Gulf War. Joint medical operations were not well-established between the armed services, and ground combat units had difficulty tracking the location of their members once they had entered the medical system; the Army and Navy had their own patient tracking systems, but those systems didn't interface with each other.[45] In the ensuing confusion, roughly 60% of patients moved during the Persian Gulf War ended up at the wrong destination.[46] TRAC^{2}ES was developed to regulate and track a patient through multiple branches of the armed services and provide in-transit visibility of that patient from her entry into the system as a Patient Movement Request (PMR) to her arrival at the destination medical facility.

TRAC^{2}ES is a web-based system that is scalable, highly available and accessible through a secure internet portal. GPMRC provides TRAC^{2}ES with 24-hour support through a well-staffed and trained help desk. Regionally, TRAC^{2}ES is also supported by a network of TPMRCs, which provides some redundancy and increases system access and availability. Another strength of the TRAC^{2}ES system is its ability to handle a large volume of complex data. *AI Magazine* explains the capabilities of TRAC^{2}ES this way: "TRAC^{2}ES… is designed to handle many thousands of patients simultaneously, which leads to a combinatorial puzzle of missions, hospitals, airports, and other resources of astronomical size and complexity."[47]

TRAC^{2}ES is managed by USTRANSCOM and therefore it is a truly joint platform. Even though the vast majority of fixed-wing assets for AE belong to the Air Force, all of the armed

services have access to the platform for patient movement. PMRs are initiated by the patient's originating medical treatment facility, and that facility could be a Navy Fleet Hospital, an Army Combat Support Hospital or an Air Force Theater Hospital. Within the military system, TRAC^{2}ES is neutral to the user's affiliated branch of service as long as the user has current DoD security credentials. TRAC^{2}ES has proven itself to be an enormously reliable and successful tool within the confines of the DoD. In 2009 alone, TRAC^{2}ES aided AE crews in the performance of 19,025 patient movements.[48]

Evaluation: Expansion of TRAC^{2}ES

TRAC^{2}ES is a DoD asset and designed for primarily for wartime military use, and this presents obstacles for adopting this platform as a shared tracking resource among other state and federal agencies. For example, TRAC^{2}ES is designed to be accessed primarily by a Common Access Card (CAC), which is a security ID issued to DoD personnel. Logon IDs and passwords may be granted without CACs, but the user must still have military-approved security access to enter the platform. TRAC^{2}ES also contains confidential protected health information on patients and therefore requires the user to have the proper background clearances and "need to know" to access the data. Because of its security structure, TRAC^{2}ES is not configured to accommodate non-military users. A civilian nurse working in a DMAT, for example, may have access to a patient's protected health information but still not have the proper military-level clearance to access a DoD system. In this scenario, the nurse would not be granted access to TRAC^{2}ES due to her potential military security risk. TRAC^{2}ES would ultimately require significant redesign and change of access controls to accommodate civilian user access. DoD leadership would likely protest any changes to TRAC^{2}ES that could introduce security vulnerabilities into the user access modules.

TRAC^{2}ES is also not an adequate "stand alone" tool for tracking patients once it is taken out of a strictly DoD environment and applied to DSCA. Federal disaster response operations are enormously complex and AE is only a part of the larger continuum of patient movement. Joe Lamana, HHS JPATS Administrator, describes TRAC^{2}ES as "a tracking system for AE only" and therefore inadequate for the task of tracking patients across the spectrum of DSCA because "TRAC^{2}ES only tracks patients from APOE to APOD."[49] HHS is concerned with tracking patients from initial medical triage and treatment through to definitive care, and AE is only a segment of that larger tracking mechanism. After treatment, HHS also tracks the disaster response patient back to their originating point of treatment, which is most likely located in that patient's home city or municipality. As stated earlier, TRAC^{2}ES is designed primarily as a patient *regulating* tool that can be used for tracking patients while in the DoD system, but it falls short of the mark when it is considered for use as a comprehensive DSCA tracking tool.

The Joint Patient Assessment and Tracking System

The Joint Patient Assessment and Tracking System (JPATS) is owned and operated by HHS. JPATS, like TRAC^{2}ES, is a web-based application accessible via the internet, although JPATS access does not require a DoD security clearance. JPATS was designed and developed strictly as a patient tracking tool, unlike TRAC^{2}ES. In another contrast to the complex capabilities and supporting infrastructure associated with TRAC^{2}ES, JPATS is relatively simple and straightforward. JPATS requires the user to enter only nine items to create a patient movement record, including such basic information as: identification number, name, gender, date of birth, and patient classification status.[50] JPATS is described by its administrators as "FEDEX for patients," since the patient is tracked all the way through the transit system from

beginning to end.[51] JPATS will even track the patient's return from treatment at a medical facility hundreds of miles from the point of injury.

Evaluation: The Adoption of JPATS

JPATS deserves strong consideration as a national patient tracking tool standard. JPATS does not contain detailed patient information, unlike many other patient tracking systems. However, this is not necessarily a disadvantage, since this means the platform is not constrained under the Health Insurance Portability and Accountability Act (HIPAA). According to Joe Lamana of HHS, "Because no medical records are tied to JPATS, it does not have to be a HIPAA-compliant system."[52] Also, due to its simple and basic design, JPATS requires much less bandwidth to run that many other comparable tracking systems, including TRAC^{2}ES. JPATS can be accessed from a mobile device, such as a tablet, as long as the user has an approved and active account on the platform. Another huge advantage of JPATS is that HHS is hosting the platform and is giving access to JPATS to state and local governments free of charge. The map in Figure 2 points out that a number of states, such as Washington, have already adopted JPATS as their standard. When adjoining states both use JPATS, continuity is maintained in the patient tracking system when a patient crosses state lines. The simplicity of JPATS' design and implementation make it a strong candidate for adoption as a national standard for tracking.

Considering Alternative Tracking Systems

JPATS and TRAC^{2}ES are not the only systems available for patient tracking in a DSCA response scenario that requires AE. A number of states have their own patient tracking systems that are broader-focused than TRAC^{2}ES and more sophisticated than JPATS. For example, New York has the New York State Evacuation of Facilities in Disasters System (NYS e-FINDS),

Wisconsin has Wisconsin Tracking, Resources, Alerts and Communication (WI Trac) and Florida has the EMS Tracking and Reporting System (EMSTARS). Can these state systems be integrated within a national patient movement and tracking network?

The biggest problem with the adoption of a federalized network of state tracking systems is that these individual systems were not designed to interface and communicate with each other. Some of the state patient movement systems are built off of commercial platforms and some are customized builds. In a Title 32 localized disaster response scenario, state and local EMS may be able to utilize their state's tracking system for comprehensive patient tracking. As soon as federal assistance is requested, however, the likelihood of the patient moving across state lines greatly increases, especially with the introduction of AE. This is because local hospitals are quickly overwhelmed during large mass casualty situations, particularly with critical care populations, and these patients are often dispersed to burn centers and other specialized treatment facilities in major metropolitan areas out of state and around the country. Once patients move across state lines, the originating medical facility loses in-transit visibility of the patients unless that tracking system can interface with TRAC^{2}ES and the gaining state's tracking system. Building a customized network application across this array of state platforms may be possible, but it would be an enormously complex undertaking.

It would be possible to adopt one state's tracking system as the national standard, but there are obstacles to this approach as well. First of all, this would require a multitude of states to agree on one state's standard, which would be a huge political challenge. Next, purchasing and hosting a new national tracking system across states would be expensive. A hospital in Texas recently purchased its own internal patient tracking system for over $700,000.[53] Although the tracking system could be simplified for statewide use and would likely receive a significant

discount from the vendor, expanding this particular tracking system for statewide use would easily run into multiple millions of dollars. The entire requested budget for the NDMS in fiscal year 2015, by comparison, was $50 million.[54] The costs for adoption of a new, sophisticated tracking system to be used across all state and federal agencies in disaster response could be prohibitively expensive; this expense would also be difficult to justify given the relatively limited occurrence of large-scale disasters.

CONCLUSIONS

Aeromedical evacuation (AE) plays an important role in federal disaster response operations, although it is only one part of the larger medical emergency support function that the NRF labels as "ESF #8." AE is a military technology that has been adopted for civilian mass casualty evacuation, and AE is very efficient and effective within the military system. However, AE is not as efficient moving and tracking civilian patients in disaster response scenarios, and this is due to interface and capability mismatches with civil authorities who use their own patient movement and tracking systems. Although adoption of a single patient movement and tracking entity across all strata of local, state and federal government may be too logistically difficult and expensive to implement, this study analyzed procedures and systems that could be implemented to reduce or close the gaps across the patient movement network.

Efficiencies of patient movement and tracking are key to rapid response, and rapid response is a critical capability of AE. As demonstrated in the efficiencies of military AE during Operation Iraqi Freedom, expeditious and coordinated patient movement saves lives, especially with critically ill and injured patients. By contrast, the relatively slow and uncoordinated federal response implemented in Hurricane Katrina resulted in unnecessary deaths through delayed treatment and delayed entry into the AE system. Joe Lamana, JPATS Administrator for HHS, summarized the situation well when he said, "Emergency medicine needs to be enacted quickly to be effective." [55] Changes have been implemented to address shortcomings identified in Hurricane Katrina, but there is still room for improvement in regard to patient movement and tracking. The following section will present recommendations to improve AE patient movement and tracking during federal disaster response operations within CONUS.

RECOMMENDATIONS

Patient movement and patient tracking are both very important components of the AE system. This study reviewed and evaluated patient movement and patient tracking systems to determine which system improvements would best bridge the current AE gaps between military and civil authorities. This study analyzed two patient movement improvement suggestions specifically for AE federal disaster response operations: CCATT expansion and adoption of the DASF with MAC-ST concept of operations. The study also analyzed a number of patient tracking systems to determine the best option to integrate patient tracking across state, federal and military AE operations.

CCATTs are highly skilled and specialized critical care teams who have proven their worth in combat and domestic operations. There are a few barriers to CCATT expansion, however. One of those barriers is funding. Recruiting and retaining CCATT members within the military system is expensive, especially when considering the salaries CCATT members can command in private practice. Bonuses help recruitment efforts, but salary limitations remain in effect for military members based on military rank structure. Another barrier to CCATT expansion is wartime tasking. CCATTs are first and foremost military assets, and so the primary focus of CCATT employment is on wartime tasking. If CCATTs are needed for disaster response but the disaster coincides with a major military operation, CCATT availability for disaster response will be severely limited. Based on analysis of these factors, CCATT expansion is not a viable option for improving the DSCA patient movement system.

Adoption of the DASF with MAC-ST concept provides a more practical option for improving DSCA AE patient movement operations. The DASF provides more AE staging capabilities than a DMAT, and it is staffed primarily by DoD AE personnel who are already

familiar with the DoD patient movement concept. The DASF provides a patient movement team familiar with TRAC^{2}ES, for example, which is the DoD's standard AE regulating and tracking system. The DASF is much better equipped to handle a large influx of civilian mass casualty patients than either a standard ERPSS-10, which has only a 10-bed patient holding capability, or a DMAT, which does not specialize in AE patient movement. MAC-STs provide additional critical care capabilities generally associated with CCATTs. The difference between MAC-STs and CCATTs is that MAC-STs do not accompany patients onto the aircraft, but MAC-STs can free up limited CCATT resources by providing the "packaging" and delivering of critical care patients to the aircraft. MAC-STs are also staffed by civilian medical professionals who can be called on in disaster response much in the same way as military reservists, thus eliminating the need for retaining full-time disaster response medical personnel.

Adoption of TRAC^{2}ES for tracking civilian AE patients across state, federal and military systems is not practical. TRAC^{2}ES was designed primarily as a patient regulating tool instead of a tracking tool, and thus it has serious shortcomings for patient tracking outside of military AE. TRAC^{2}ES does not interface well with non-DoD tracking systems, especially concerning the transfer of patient electronic health record information. TRAC^{2}ES has security restrictions that make it difficult for non-DoD personnel to access the system. TRAC^{2}ES is necessary and efficient for patient regulating and movement procedures within military AE, but civil response cannot adequately function with TRAC^{2}ES as an all-encompassing tracking tool in its current implementation.

Adoption of JPATS for integrated patient tracking across local, state and federal systems makes the most practical sense of any tools evaluated in this study. JPATS is not an overly sophisticated patient tracking system, but that actually plays to its advantage in comparison

studies. JPATS is a simple, straightforward patient tracking tool that provides tracking from point of origin to point of destination. JPATS does not contain HIPAA-compliant patient data, and therefore an interface for electronic medical record data is not needed between JPATS and a state tracking system. JPATS operates over a simple internet connection and does not require a complex supporting infrastructure, unlike TRAC^{2}ES or some other tracking tools. JPATS can be run in conjunction with TRAC^{2}ES so that patient information is entered into both systems simultaneously by co-located tracking teams, which provides tracking continuity on both the front and back ends of the AE system. JPATS is administered by HHS and is provided free of charge to any states who wish to adopt it for their own patient tracking. The sum of these practical reasons make JPATS the best choice for integrated patient tracking across state, federal and military systems in use today.

Upon initial analysis of alternative tracking systems currently in use across the states, there is no single state or commercial patient tracking system currently in use that is as practical and cost-efficient as JPATS. There are more sophisticated tracking programs available from commercial vendors and homegrown state systems, but none of the systems evaluated have the simple, streamlined interface of JPATS. Purchase and implementation of a new system also comes at a significant cost, and additional implementation costs are difficult to justify when the costs of the existing JPATS infrastructure are mostly due to hardware maintenance and upkeep.

Summation

In summary, this research study supports the adoption of JPATS as the standard for patient tracking integration and broader implementation of the DASF with MAC-ST concept for patient movement in AE federal disaster response operations. Although both patient tracking and patient movement systems should be employed, consolidated patient tracking is presents the

biggest gap in current operations. Currently, the best solution to fill this gap is JPATS. Once patients enter the AE system, patient care and rapid transport works well, but unregulated patients are generally not moved through the military AE system. If patients are not regulated for movement through an AE tracking system, their movement may be delayed. Delays to medical treatment can translate into needless patient suffering and even death in severe cases, and this is why patient tracking improvements are even more important than improvements to patient movement. Universal adoption of JPATS is the single biggest improvement that could be made to the existing AE patient movement and tracking process in CONUS federal disaster response operations.

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